COVID-19 induced PTSD: Stressors for trauma and acute care surgeons

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ABSTRACT

Background: At the peak of the pandemic, acute care surgeons at many hospitals were reassigned to treat COVID-19 patients. However, the effect of the pandemic on this population who are well versed in stressful practice has not been fully explored.

Methods: A web-based survey was distributed to the members of the Eastern Association for the Surgery of Trauma (EAST). PTSD and the personal and professional impact of the pandemic were assessed. A positive screen was defined as a severity score of ≥ 14 or a symptomatic response to at least 5 of the 6 questions on the screen.

Results: A total of 393 (17.8%) participants responded to the survey. The median age was 43 (IQR: 38-52) and 238 (60.6%) were male. The majority of participants were surgeons (351, 89.3%), specializing in general surgery/trauma (379, 96.4%). The main practice type and setting were hospital-based (350, 89%) and university hospital (238, 60.6%), respectively. The incidence of PTSD was 16.3% when a threshold severity score of ≥ 14 was used and 5.6% when symptomatic responses were assessed. Risk factors for a positive PTSD screen included being single/unmarried (p = 0.02), having others close to you contract COVID-19 (p = 0.02), having family issues due to COVID-19 (p = 0.0004), rural (p = 0.005) and suburban (p = 0.047) practice settings, a fear of going to work (p = 0.001), and not having mental health resources provided at work (p = 0.03).

Conclusion: The COVID-19 pandemic had a psychological impact on surgeons. Although acute care surgeons are well versed in stressful practice, the pandemic nevertheless induced PTSD symptoms in this population, suggesting the need for mental health resources.

1. Introduction

The COVID-19 pandemic has taken a toll on healthcare workers, as most have worked additional shifts and overtime due to increased patient volume. Direct contact with COVID-19 infected patients and increased workload have been major contributors to increased stress levels among healthcare workers. Moreover, the Centers for Disease Control and Prevention (CDC) has reported that over one million healthcare personnel have been infected with COVID-19. This number is suspected to be much higher since occupation was not initially reported in many infected cases.[1] Previous studies have shown that after the outbreak of other coronaviruses such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), healthcare workers developed symptoms of post-traumatic stress disorder (PTSD).[2–7] Due to the novelty of the virus and the lack of drug treatments or a vaccine in the early phase of the pandemic, COVID-19 caused heightened anxiety and fear among healthcare workers.[8–12]

It is not uncommon for healthcare workers such as trauma surgeons, emergency medicine physicians, nurses, and emergency medical technicians to experience PTSD as a result of the cumulative stress of practice.[13–16] Acute care/trauma surgeons, in particular, have extensive experience in physically and mentally demanding situations and are trained to manage major catastrophes such as mass casualty incidents. As a result of the COVID-19 surge at many institutions, elective cases were canceled and surgical staff were redeployed to actively participate in the care of COVID-19 patients. However, the effect of the pandemic on this population who are well versed in stressful practice has been assessed by only a few studies.[17–19]

There are several validated tools to assess PTSD in both military and civilian populations. The PTSD Checklist-Civilian Version (PCL-C) is a

17-item self-report measure reflecting the Diagnostic and Statistical Manual of Mental Disorders-IV-TR (DSM-IV-TR) symptoms of PTSD.[20–24] Studies have shown that the PCL-C and two shorter versions are reliable and valid in assessing PTSD in healthcare settings.[20,22,25] The goal of this study is to determine the psychological effect of COVID-19 on acute care surgeons during the initial outbreak, using the abbreviated PLC-C screen.

2. Methods and materials

The six-item brief version of the PCL-C questionnaire (PCL-6) was used to screen for PTSD, along with questions on health fear, job stress, and financial impact. A web-based survey was developed using SurveyMonkey and distributed to the members of the Eastern Association for the Surgery of Trauma (EAST). Prior to distribution, the study was piloted and refined among a small group of surgeons, valuable feedback from the EAST Research Committee was also incorporated into the survey. Three email notifications containing the link to the survey were sent during the time period of September 28th to December 11th, 2020; data was collected until January 4th, 2021. EAST members were informed that participation was voluntary and the results of the survey would be used for research purposes only and all participants would remain anonymous. Each IP address could only complete the survey once. This study was approved as an exempt study by our Institutional Review Board. There was no informed consent, as completing the survey was considered consent to participate.

The COVID-19 pandemic was specified as the traumatic event to be considered when responding to the questions in the PCL-6 screening tool. Therefore, positive screens should be due to the pandemic itself and not to other stressful events in general. There are three validated methods of scoring the PCL-6 screen that were all used in this study. Response options for the PCL-6 are: "*not at all*" = 1 point, "*a little bit*" = 2 points, "*moderately*" = 3 points, "*quite a bit*" = 4 points, or "*extremely*" = 5 points. The PCL-6 screen yields a total score ranging from 6 to 30, with higher scores indicating greater PTSD severity. A total symptom severity score for each respondent was determined by summing the scores for each of the six questions. A threshold score of 14 or greater was considered a positive PTSD screen.[20,22,26] Response categories "moderately", "quite a bit", and "extremely" were considered symptomatic responses whereas responses "not at all" and "a little bit" were considered asymptomatic. A symptomatic response to a minimum of five questions of the PCL-6 tool was considered a presumptive diagnosis of PTSD. The study did not assess whether respondents had PTSD symptoms but did not met diagnostic criteria for PTSD. A threshold score of 14 or greater or symptomatic responses to five of the questions on the screen, either separately or combined, both indicated diagnostic criteria for PTSD. A Likert scale (strongly disagree, disagree, neutral, agree, strongly agree) was used for the additional questions on the personal and professional impact of COVID-19. For the question on personal impact, no definition was provided for "family issues", the study did not limit the interpretation of the term to specific examples. Respondent demographics were also collected and included age, gender, relationship status, job role, specialty, practice type, practice venue, and practice location. A qualitative free text component was also included for respondents to provide additional comments. Respondents who completed all six questions in the PCL-6 screen were included in the study.

GraphPad Prism version 9 (GraphPad Software Inc., La Jolla, CA) and R version 4.0.2[27] were used for statistical analysis. Respondents were stratified into groups for analysis based on 1) the validated threshold score of <14 or ≥14, as well as 2) the pattern and level of responses into symptomatic vs. non-symptomatic. Categorical variables are expressed as count (*N*) and percent (%), and significance testing was done using Fisher's exact test. Stepwise regression was utilized to examine factors associated with increasing PCL-6 scores (linear regression) and higher odds of meeting criteria for a positive PTSD screen (logistic regression).

All non-PCL-6 questions regarding attitudes and effects of the pandemic with more than two response levels were transformed into a three-level factor that varied depending on the original question. Questions with '-agree' based responses were categorized as "disagree" ("strongly disagree"; "disagree" responses), "neutral", and "agree" ("agree" and "strongly agree") whereas '-likely' based responses were categorized as "unlikely" ("extremely unlikely" and "unlikely"), "neutral", and "likely" ("likely" and "extremely likely"). "Neutral" responses were used as the reference class for most regression modeling. This variable transformation was performed to reduce the chance of spurious results due to the heterogeneity of responses in our sample, as well as to decrease the familywise alpha rate and protect against needing multiple post-hoc multiple comparisons across PCL-6 response levels. Regression modeling was performed using all demographic variables and non-PCL-6 questions querying the effects of the pandemic as independent variables, with either total PCL-6 score or a binary indicator for positive PTSD symptomology as dependent variables for linear and logistic regression models, respectively.

Free-text responses were first processed by identifying and extracting sentences and phrases describing the overarching motifs present in the content. These phrases were then synthesized and abstracted into discrete themes that would permit frequency counts to summarize the responses. Relevant phrases and quotations are presented to support identified themes, as well as add context and provide real-world examples.

3. Results

The survey was distributed to 2302 EAST members of which 410 (17.8%) responded. A total of 393 (95.8%) respondents completed all six questions of the abbreviated PCL-6 screen and were included for analysis. The median age was 43 years (IQR: 38–52) and 238 (60.6%) were male. The majority of responses were from attending physicians (n = 351, 89.3%) and the most common specialty was general surgery/ trauma (n = 379, 96.4%). Venue of practice was primarily university/ academic hospital (n = 238, 60.6%), and most respondents' practices were hospital-based (n = 350, 89%). Sixty-four of the 393 respondents (16.3%) scored 14 or above on the PCL-6 screen and 22 (34.4%) of those with scores ≥14 had symptomatic responses to at least five of the six questions. Table 1 presents responses to the six PCL-6 questions aggregated by scores above or below the threshold score of 14. Question 4 on 'feeling distant and cut-off from others' had the most symptomatic respondents (n = 139, 42.2%), with 12.1% more females giving a symptomatic response (p = 0.02). Additional details are provided in Table 1.

Univariate analysis of demographic factors was performed based on both the threshold score of 14 and symptomatic vs. asymptomatic responses (Table 2). Symptomatic respondents were more likely to be divorced (13.6% vs. 3.2%; p = 0.001), and to be from a rural practice location (22.7% vs. 7.3%; p = 0.02), when compared to asymptomatic respondents. When job position, specialty area, venue of practice, and practice type were assessed, there were no significant differences between respondents who scored <14 vs. ≥14 or respondents who were asymptomatic vs. symptomatic (Table 3). Additional details are provided in Tables 2 and 3

The results from evaluation of the personal and professional impacts of COVID-19 are presented in Table 4. Respondents who screened positive by either or both criteria, were significantly more likely to report others close to them contracted COVID-19 or to have family issues caused by COVID-19. The fear of going to work was exacerbated among those with above-threshold PCL-6 scores relative to those scoring <14 (39% vs. 12.5%; p < 0.00001) and those with a symptomatic response pattern as compared with asymptomatic respondents (50% vs. 12.5%; p = 0.0002). One-third of those surveyed (n = 133, 33.8%) reported lost income as a result of the pandemic, and those with a threshold score ≥14 vs. a score <14 were more likely to report a decrease in income (p = 0.02). Although most respondents reported mental health resources as

Table 1
The abbreviated PCL-C PTSD screen stratified by the threshold score.

	Abbreviated PCL-C Questions	PTSD <14 (N = 329), n, %					PTSD ≥14 (N = 64), n, %				
		Not at All	A little bit	Moderately	Quite a bit	Extremely	Not at All	A little bit	Moderately	Quite a bit	Extremely
1)	I have repeated, disturbing memories, thoughts, or images related to my stressful experience with COVID-19.	247 (75.1)	67 (20.4)	15 (4.6)	0 (0)	0 (0)	6 (9.4)	22 (34.4)	17 (26.6)	15 (23.4)	4 (6.2)
2)	I feel very upset when something reminds me of my stressful experience with COVID-19.	259 (78.7)	65 (19.8)	5 (1.5)	0 (0)	0 (0)	6 (9.4)	17 (26.6)	25 (39.1)	12 (18.7)	4 (6.2)
3)	I avoid activities or situations because they remind me of my stressful experience with COVID-19.	293 (89.1)	34 (10.3)	2 (0.6)	0 (0)	0 (0)	14 (21.9)	19 (29.7)	18 (28.1)	10 (15.6)	3 (4.7)
4)	I feel distant or cut off from other people due to my experience with COVID-19.	158 (48)	88 (26.7)	52 (15.8)	25 (7.6)	6 (1.8)	2 (3.1)	6 (9.4)	14 (21.9)	24 (37.5)	18 (28.1)
5)	I feel irritable or have angry outbursts due to my experience with COVID-19.	227 (69)	87 (26.4)	13 (3.9)	2 (0.6)	0 (0)	4 (6.2)	20 (31.2)	20 (31.2)	14 (21.9)	6 (9.4)
6)	I have difficulty concentrating due to my experience with COVID-19.	263 (80)	60 (18.2)	6 (1.8)	0 (0)	0 (0)	9 (14.1)	17 (26.6)	16 (25)	16 (25)	6 (9.4)

Table 2
Demographic factors stratified by PTSD threshold score and by symptomatic responses.

Variable	All Patients (N = 393), n, %	PTSD Score <14 (N = 329), n, %	PTSD Score ≥14 (N = 64), n, %	P value	Asymptomatic (N = 371), n, %	Symptomatic (N = 22), n, %	P value
Age (years)	43 (38, 52)	43 (38, 52.5)	42 (38, 50)	0.17	43 (38, 52)	40.5 (38, 50)	0.47
Gender							
Male	238 (60.6)	205 (62.3)	33 (51.6)	0.12	227 (61.2)	11 (50)	0.37
Female	150 (38.2)	119 (36.2)	31 (48.4)	0.07	139 (37.5)	11 (50)	0.26
Other	3 (0.8)	3 (0.9)	0 (0)	>0.99	3 (0.8)	0 (0)	>0.99
Not documented	2 (0.5)	2 (0.6)	0 (0)	>0.99	2 (0.5)	0 (0)	>0.99
Relationship Status							
Single	47 (11.9)	36 (10.9)	11 (17.2)	0.20	42 (11.3)	5 (22.7)	0.16
Married	312 (79.4)	267 (81.1)	45 (70.3)	0.06	301 (81.1)	11 (50)	0.001
Divorced	15 (3.8)	11 (3.3)	4 (6.2)	0.28	12 (3.2)	3 (13.6)	0.04
Separated	5 (1.3)	4 (1.2)	1 (1.6)	0.59	4 (1.1)	1 (4.5)	0.25
Domestic Partnership	14 (3.6)	11 (3.3)	3 (4.7)	0.71	12 (3.2)	2 (9.1)	0.18
Have Kids (Yes)	279 (71)	240 (72.9)	39 (60.9)	0.07	269 (72.5)	10 (45.4)	0.01
Practice Location							
Urban	278 (70.7)	243 (73.9)	35 (54.7)	0.004	266 (71.7)	12 (54.5)	0.09
Suburban	83 (21.1)	65 (19.8)	18 (28.1)	0.13	78 (21)	5 (22.7)	0.79
Rural	32 (8.1)	21 (6.4)	11 (17.2)	0.01	27 (7.3)	5 (22.7)	0.02
Geographical Region							
West	51 (13)	40 (12.1)	11 (17.1)	0.31	46 (12.4)	5 (22.7)	0.18
Midwest	93 (23.6)	82 (24.9)	11 (17.1)	0.20	89 (24)	4 (18.2)	0.80
South	139 (35.4)	117 (35.6)	22 (34.4)	0.89	133 (35.8)	6 (27.3)	0.50
Northeast	103 (26.2)	84 (25.5)	19 (29.7)	0.53	96 (25.9)	7 (31.8)	0.62
Non-US	6 (1.5)	6 (1.8)	0 (0)	0.59	6 (1.6)	0 (0)	>0.99

being available (n = 219, 55.7%), those with threshold scores ≥14 more often reported not having mental health resources at their institution (p = 0.002). Additional information is provided in Table 4.

Stepwise linear regression was performed to identify important parameters associated with increasing PCL-6 score (Table 5). Respondents who were unmarried (p = 0.02), and who practiced in the West (p = 0.02) and in rural areas (p = 0.001) had higher PCL-6 scores. Professionally, respondents who feared going to work (p = 0.001) or who expressed that fear affected their clinical practice or decision making (p = 0.01) had higher PCL-6 scores. Not surprisingly, the lack of available mental health resources (p = 0.03) was associated with increasing PCL-6 scores. Similar results were observed when multivariable logistic regression was performed (Table 6).

A total of 65 respondents (16.5%) also contributed free-text responses regarding their thoughts and experiences surrounding the COVID-19 pandemic. The median age of these respondents was 48 years (IQR: 40–56). Most respondents were male (n = 40, 61.5%), married (n = 54, 83.1%) with children (n = 48, 73.8%), and did not screen positive for PTSD (n = 50, 76.9%). Qualitative thematic analysis revealed ten primary themes present in the responses: pandemic management (33/65; 51%), national/state government (25/65; 39%), the public (20/65; 30%), working conditions (17/65; 26%), patient care (15/65; 23%), communications/practice guidelines (13/65; 20%), stress (13/65; 20%), mental/physical health (11/65; 17%), financial concerns (10/65; 15%), and family (9/65; 14%).

4. Discussion

Post-traumatic stress disorder among healthcare providers has been a major concern during the pandemic and the toll of this unique stressor has impacted healthcare workers in a variety of ways. Previous studies have shown that 15–22% of surgical residents and trauma surgeons screened positive for PTSD induced by routine practice, and this proportion was even higher (40–57%) when only symptoms of PTSD were

Table 3
Surgical Job Role and Practice Details stratified by PTSD Threshold Score and by Symptomatic Responses.

Variable	All Patients (N = 393), n, %	PTSD Score <14 (N = 329), n, %	PTSD Score ≥14(N = 64), n, %	P value	Asymptomatic (N = 371), n, %	Symptomatic (N = 22), n, %	P value
Job Position							
Attending Physician	351 (89.3)	290 (88.1)	61 (95.3)	0.12	329 (88.7)	22 (100)	0.15
Surgical Fellow	12 (3)	12 (3.6)	0 (0)	0.23	12 (3.2)	0 (0)	>0.99
Surgical Resident	12 (3)	10 (3)	2 (3.1)	>0.99	12 (3.2)	0 (0)	>0.99
Physician Assistant	2 (0.5)	2 (0.6)	0 (0)	>0.99	2 (0.5)	0 (0)	>0.99
Nurse Practitioner	9 (2.3)	9 (2.7)	0 (0)	0.37	9 (2.4)	0 (0)	>0.99
Registered Nurse	5 (1.3)	4 (1.2)	1 (1.6)	0.60	5 (1.3)	0 (0)	>0.99
Other	1 (0.2)	1 (0.3)	0 (0)	>0.99	1 (0.3)	0 (0)	>0.99
Not Documented	1 (0.2)	1 (0.3)	0 (0)	>0.99	1 (0.3)	0 (0)	>0.99
Specialty Area<							
General Surgery/ Trauma	382 (97.2)	318 (96.7)	64 (100)	0.22	359 (96.8)	22 (100)	>0.99
Pediatric Surgery	6 (1.5)	6 (1.8)	0 (0)	0.59	6 (1.6)	0 (0)	>0.99
Orthopedic Surgery	1 (0.2)	1 (0.3)	0 (0)	>0.99	1 (0.3)	0 (0)	>0.99
Anesthesia	2 (0.5)	2 (0.6)	0 (0)	>0.99	2 (0.5)	0 (0)	>0.99
Emergency Medicine	2 (0.5)	2 (0.6)	0 (0)	>0.99	2 (0.5)	0 (0)	>0.99
Primary Venue of Practice							
University/Academic Hospital	238 (60.6)	202 (61.4)	36 (56.2)	0.48	227 (61.2)	11 (50)	0.37
Community Hospital	140 (35.6)	114 (34.6)	26 (40.6)	0.39	130 (35)	10 (45.4)	0.36
Private Practice	7 (1.8)	5 (1.5)	2 (3.1)	0.32	6 (1.6)	1 (4.5)	0.33
Military Hospital	7 (1.8)	7 (2.1)	0 (0)	0.60	7 (1.9)	0 (0)	>0.99
Other	1 (0.2)	1 (0.3)	0 (0)	>0.99	1 (0.3)	0 (0)	>0.99
Practice Type							
Hospital-based	351 (89.3)	295 (89.7)	56 (87.5)	0.66	330 (88.9)	21 (95.4)	0.49
Academic	2 (0.5	2 (0.6)	0 (0)	>0.99	2 (0.5)	0 (0)	>0.99
Military	1 (0.2)	1 (0.3)	0 (0)	>0.99	1 (0.3)	0 (0)	>0.99
Independent	32 (8.1)	25 (7.6)	7 (10.9)	0.45	31 (8.3)	1 (4.5)	>0.99
Freelance/Locum Tenens	5 (1.3)	4 (1.2)	1 (1.6)	0.59	5 (1.3)	0 (0)	>0.99
Not documented	2 (0.5)	2 (0.6)	0 (0)	>0.99	2 (0.5)	0 (0)	>0.99

Table 4
Personal and professional impact of COVID-19 stratified by PTSD threshold score and by symptomatic responses.

Stressors	PTSD <14 (N = 329), n, %	PTSD ≥14(N = 64), n, %	P Value	Asymptomatic (N = 371), n, %	Symptomatic (N = 22), n, %	P Value
I contracted COVID-19 (Yes)	23 (7)	5 (7.8)	0.79	26 (7)	2 (9.1)	0.66
Others close to me contracted COVID-19 (Yes)	106 (32.2)	32 (50)	0.01	124 (33.4)	14 (63.6)	0.005
I had family issues due to COVID-19 (Yes)	133 (40.4)	49 (76.6)	<0.0001	163 (43.9)	17 (77.3)	0.003
Increased stress level (Yes)	239 (72.6)	61 (95.3)	<0.0001	278 (74.9)	21 (95.4)	0.04
I feared bringing COVID-19 home to my family (Agree)	242 (73.6)	57 (89.1)	0.006	279 (75.2)	20 (90.9)	0.12
I feared going to work (Agree)	41 (12.5)	25 (39)	<0.0001	55 (14.8)	11 (50)	0.0002
Risk of contracting COVD-19 from patients (Likely)	58 (17.6)	26 (40.6)	0.0002	73 (19.7)	11 (50)	0.002
Risk of death due to caring for COVID-19 patients (Likely)	20 (6.1)	7 (10.9)	0.18	23 (6.2)	4 (18.2)	0.05
Fear affected my clinical practice/decision making (Agree)	79 (24)	33 (51.6)	<0.0001	98 (26.4)	14 (63.6)	0.0004
I preferred not to care for COVID-19 patients (Agree)	70 (21.3)	18 (28.1)	0.25	81 (21.8)	7 (31.8)	0.29
Mental health resources were provided at my institution (No)	64 (19.4)	21 (32.8)	0.02	78 (21)	7 (31.8)	0.28
My workload has increased (Yes)	151 (45.9)	36 (56.2)	0.13	173 (46.6)	14 (63.6)	0.13
My income decreased during the pandemic (Yes)	103 (31.3)	30 (46.9)	0.02	124 (33.4)	9 (40.9)	0.49
The pandemic was handled well at my institution (No)	49 (14.9)	16 (25)	0.06	58 (15.6)	7 (31.8)	0.07

assessed.[14,15] Recent COVID-19 studies have shown that female and less experienced surgeons, as well as surgeons who knew someone who was diagnosed with COVID-19 had higher stress levels.[18,19] The current study also assessed the psychological effects of the pandemic on the acute care/trauma surgical community, which is acclimated to stressful practice. The PCL-C screening tool, a validated assessment for PTSD, was utilized to make a presumptive diagnosis of PTSD among respondents unlike other recent COVID-19 studies. Additionally, in a recent global survey of surgeons, the U.S.A was under-represented[17] whereas the respondents to our survey were predominantly from the U.S.A, which has been the most affected country to date.[28]

In our study population, the 16.3% incidence rate of PTSD was within the range of previously published rates. The study by Joseph et al., which utilized the same screening tool, showed a similar incidence of PTSD (15%) among acute care surgeons due to the stress of daily practice.[14] If this study by Joseph et al. is used as a baseline/historical control, it indicates that our incidence of PTSD due to the pandemic was very similar to the incidence of PTSD due to day-to-day stressful practice. Our study also utilized a second method to assess the screening tool, which analyzed the number of symptomatic responses to the questions

Table 5
Stepwise Linear Regression based on the total PTSD Score.

Stressors	Estimates	95% CI	P Value
Have Kids (Yes)	−0.93	−1.85−−0.01	0.047
Relationship Status: Unmarried	1.27	0.17–2.37	0.02
Geographical Region: South	−0.33	−1.26–0.60	0.49
Geographical Region: Midwest	−0.81	−1.84–0.22	0.12
Geographical Region: West	1.49	0.26–2.72	0.02
Suburban Practice Setting	0.44	−0.46–1.33	0.34
Rural Practice Setting	2.16	0.85–3.47	0.001
Others close to me contracted COVID-19 (Yes)	1.03	0.27–1.79	0.008
I had family issues due to COVID-19 (Yes)	1.85	1.07–2.63	<0.001
Increased Stress Level (Yes)	1.20	0.30–2.10	0.009
I feared going to work (Agree)	2.18	0.94–3.42	0.001
Fear affected my clinical practice/decision making (Agree)	1.55	0.34–2.77	0.01
Risk of death due to caring for COVID-19 patients (Unlikely)	−1.37	−2.31−−0.44	0.004
Mental health resources were provided at my institution (No)	1.17	0.10–2.25	0.03
Intercept	7.42	5.62 - 9.21	<0.001
Observations = 361 AIC = 1925.685 R2/ R2 adjusted = 0.398/0.367			

Table 6
Multivariable logistic regression based on the PTSD Threshold Score of ≥14.

Predictors	Odds Ratio	95% CI	Risk Ratio	95% CI	P Value
Had Children (Yes)	0.28	0.12 - 0.61	0.33	0.15–0.67	0.002
Job Role: Attending	3.81	0.91–26.70	3.32	0.91–11.35	0.10
Geographical Region: South	0.94	0.39–2.33	0.95	0.43–1.89	0.90
Geographical Region: Midwest	0.45	0.16–1.24	0.50	0.18–1.19	0.13
Geographical Region: West	2.44	0.76–7.69	1.95	0.79–3.57	0.13
Suburban Practice Setting	2.34	1.00–5.42	2.01	1.00–3.50	0.047
Rural Practice Setting	4.65	1.57–13.81	3.20	1.47–5.32	0.005
Others close to me contracted COVID-19 (Yes)	2.36	1.16–4.89	2.03	1.14–3.34	0.02
I had family issues due to COVID-19 (Yes)	4.49	2.01–10.74	3.63	1.88 - 6.46	0.0004
Increased Stress Level (Yes)	8.26	1.75–81.37	7.00	1.72–27.26	0.03
I feared going to work (Agree)	2.53	0.97–6.90	1.92	0.97–3.11	0.06
Fear affected my clinical practice/decision making (Agree)	2.65	0.92–8.32	2.16	0.93–4.15	0.08
Mental health resources were provided at my institution (No)	3.90	1.32–12.80	3.11	1.29–6.30	0.02

of the screen. The rate of PTSD among respondents was markedly lower (5.6%) when this more stringent assessment criteria was utilized, implying that even though COVID-19 affected surgeons, the stress induced was not as severe as the stress of daily practice. Alternatively, this can be interpreted as respondents were less affected by COVID-19 due to their familiarity with stressful practice. The use of a cutoff score in analyzing the PCL-C screen is more commonplace compared to the use of symptomatic responses, therefore the incidence rate of 16.3% is more likely representative of our study population.

Respondents who screened positive for PTSD were mostly from the South and Northeast regions of the U.S.A. The size of the population within the practice location also played a significant role in PTSD diagnosis as respondents from rural areas were more likely to screen positive for PTSD. This may be due to the fear or lived experience of

limited resources, the inability to increase surge capacity, and the fear of the healthcare system and workforce being rapidly overwhelmed.

A greater proportion of females screened positive for PTSD. However, unlike other studies, there was no significant association between gender and a positive PTSD screen. The small size of our study population may have precluded detecting an effect mediated by gender. The PCL-6 PTSD screen encompasses different behaviors that compromise the core PTSD symptoms: re-experiencing, avoidance/numbing, negative cognitions and mood, and arousal/reactivity. Females had significantly more symptomatic responses to the PCL-6 question that addressed negative cognitions and mood, which assessed whether the respondent felt distant or isolated from others. Interestingly, being divorced or single, as well as not having children, was associated with PTSD in our population. This provides a possible explanation for why respondents, especially females, felt isolated from others. Likewise, Mavroudis et al. demonstrated that female surgeons experienced more stress than males regardless of parental status.[18] Additionally, we found that having others close to you diagnosed with COVID-19 or having family issues due to COVID-19 were risk factors for developing PTSD. This suggests that the added burden of family issues in combination with work-related stress potentially had a compound effect on some respondents, ultimately resulting in PTSD.

A significant number of respondents who screened positive for PTSD feared going to work and reported that fear affected their clinical practice and decision making. Interestingly, the likely risk of death due to caring for COVID-19 patients was not a predictor of PTSD in our population. This suggests that the fear of going to work is more likely linked to contracting COVID-19 and possibly spreading it to others rather than the fear of dying from COVID-19 oneself. Although not a risk factor, the financial impact of the pandemic was also a stressor, as more respondents with PTSD reported a decrease in income than those without PTSD. The ambiguity of how long the pandemic would last and consequently how long the loss of income would persist most likely increased the stress level of some respondents. The side effects of the pandemic included the closure of many businesses and a substantial loss of jobs across the U.S.A. Hospitals were not immune to these effects, especially in rural areas. Rural hospitals are often the economic anchor in smaller communities; loss of income or job security would certainly be expected to have a substantial impact on employees. The lack of mental health resources at some institutions was also a stressor and a risk factor for PTSD. Thus, respondents whose institutions did not have such resources available who also screened positive for PTSD had no coping resources, no comfort/support provided or professional outlet to vent, which possibly fueled their stress level.

Based on the qualitative analysis performed, pandemic management by the federal government was seen as being handled poorly whereas local, state, and hospital/healthcare systems were largely viewed as doing a decent job. Lack of communication and collaboration between federal and state authorities was considered a major ("demoralizing") failure. Some stated that health authorities at all levels should have been "more honest" regarding the "many unknowns" during the initial stages of the pandemic rather than "promulgating media-based propaganda" that led to "unnecessary fear". Concern was expressed that the apparent lack of federal support and failure to "flatten the curve" would lead to a long-standing "tarnishing" of the professional reputation of healthcare providers. Some questioned the rationale of their peers in suggesting that COVID-19 was nothing to fear, while others noted society's "glib and inept" response.

Furthermore, public themed responses were both positive and negative. Positive themes dovetailed with the patient care theme and encompassed public well-being: physical and mental health, availability of care, and the consequences associated with elective case cancellation. Negative themes questioned the seeming difficulty among the public to give equal buy-in regarding social distancing/masking policies while providers made huge sacrifices to care for them. Essentially, many could not fathom the inability of the public to adopt a "we are all in this

together" attitude until they were directly affected. Multiple responses in both the working conditions and finance themes suggested that "corporate greed" resulted in the furlough/elimination of positions within healthcare (and the economy as a whole), with the resultant staffing and supply shortages potentially putting patients at risk, while also giving rise to feelings of being overworked and ignored by leadership. Communication and coordination of patient care within and across teams was also noted as being difficult, particularly due to the rapidly evolving care guidelines.

There are several limitations to this prospective study. Namely, the information gathered in this study was self-reported, as a Clinician-Administered PTSD Scale (CAPS) was not practical to administer given the large potential sample size (>2000) and resource constraints. Further, the baseline prevalence of PTSD and personal emotional trauma history of respondents was unknown. Therefore, the actual incidence of PTSD may be lower or higher due to reporting bias. However, participants were asked specifically about stress induced by the COVID-19 pandemic. The study by Joseph et al. was used as a historical control for the baseline incidence of PTSD among acute care surgeons.[14]

Additionally, although the survey was conducted over a three-month period it is still considered a single time point and, not a longitudinal observation, as each subject was only able to respond once. It is also important to note that since the respondents to our survey were predominantly acute care/trauma surgeons, many surgeons that primarily perform elective cases were likely not represented in our sample. Moreover, the overall low response rate may suggest that surgeons and other EAST members who may have been truly overwhelmed or had PTSD may not have participated in the survey. Additionally, despite assured anonymity, fear of discovery and the stigma of being labeled with mental health issues possibly factored into non-participation. Lastly, correlations between COVID-19 infection rates, geographical locations, and PTSD incidence were not assessed. It would be interesting to determine if states with higher infections rates had more respondents who screened positive for PTSD.

5. Conclusions

Surgeons were redeployed to treat COVID-19 patients at many hospitals across the country and were not immune from pandemic aftereffects. Although acute care/trauma surgeons are familiar with stressful practice that did not prevent COVID-19 induced PTSD. Factors such as being single, having others close to them get infected with COVID-19, and fear of going to work all contributed to PTSD symptoms, sometimes further compounded by a lack of available mental health resources at their hospital. The plethora of issues surrounding the COVID-19 pandemic resulted in increased stress levels pervading both work and home, leading to feelings of "exhaustion", "sadness", "anger", "fear", being "broken", and "not okay". Mental health screening and support for surgeons, especially those exhibiting some of the risk factors identified here is a necessity. Even without the stress of the pandemic, acute care/trauma surgeons are at risk of PTSD due to their day-to-day demanding practice. Future studies should evaluate the implementation of mental health/wellness resources for surgeons and their impact on PTSD symptoms and burnout among surgeons. Interventions for mental health support should be implemented institutionally, as well as at a national-level via trauma organizations.

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Declaration of competing interest

All authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2022.02.060.

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